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| 10/643,638 | 08/18/2003 | Peng Zhou | COOL-01500 | 4432 |
| 28960 | 7590 | 08/09/2005 | EXAMINER | |
| HAVERSTOCK & OWENS LLP 162 NORTH WOLFE ROAD SUNNYVALE, CA 94086 | | | ZEC, FILIP | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 3744 | |

DATE MAILED: 08/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/643,638

Applicant(s)

ZHOU ET AL.

Examiner

Filip Zec

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/10, 5/4 and 7/27.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 2-5, filed on 5/4/2005, with respect to the rejection(s) of claim(s) 1-32 under 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Japanese Patent 01-256775 to Yamaguchi. As such, this Office Action is being made non-final to afford the applicants the opportunity to respond to the new grounds of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips" by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi. Koo et al. discloses applicant's basic inventive concept, a method of cooling a heat-generating device (IC Chip, FIG. 1), using a pump (Electrokinetic pump, FIG. 1) to cause a fluid flow in a heat exchanger (Microchannel Heat Exchanger, FIG. 1) and having a heat rejector (Condenser, FIG. 1) for rejecting heat from the system, located downstream from the heat exchanger, substantially as claimed with the exception

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of stating specifically that the pressure of the refrigerating fluid is adjusted in the system to correspondingly adjust the boiling point temperature of the fluid in the heat exchanger.

Yamaguchi et al. shows adjusting the pressure of the refrigerating fluid in the system to correspondingly adjust the boiling point temperature of the fluid in the heat exchanger

(constitution) to be old in the refrigeration art. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of

Yamaguchi to modify the system of Koo et al., by adjusting the pressure of the refrigerating fluid in the system to correspondingly adjust the boiling point temperature of the fluid in the heat exchanger in order to permit higher fluid temperatures, which maximizes the heat exchanging capability of heat exchanger (constitution).

4. Claims 2, 27 and 28 rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of U.S. Patent 6,182,742 to Takahashi et al. Koo in view of Yamaguchi discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat exchanger, substantially as claimed with the exception of stating specifically that the pressure of the refrigerating fluid is adjusted in the system by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid. Takahashi shows adjusting pressure of the refrigerating fluid in the system by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid (temperature sensors, located at the distribution header, prior to entering the heat exchanger, col 7, lines 15-22 and col 8, lines 12-18) to be old in the refrigeration art. Therefore, it would have been obvious to

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one having ordinary skill in the art at the time the invention was made from the teaching of Takahashi to modify the system of Koo in view of Yamaguchi, by adjusting the operating conditions of the pump in response to the change in the temperature of the fluid in order to adjust pressure of the refrigerating fluid in the system *prior* to it entering the heat exchanger.

5. Claims 3, 14-21, 26, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of US PGPUB-Document US 2003/0121274 to Wightman. Koo in view of Yamaguchi discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat exchanger, substantially as claimed with the exception of stating specifically that the pressure of the refrigerating fluid is adjusted in the system by adjusting an orifice coupled to the heat exchanger in response to the change in the temperature of the fluid. Wightman shows adjusting pressure of the refrigerating fluid in the system by adjusting an orifice (18, FIG. 1) coupled to the heat exchanger (14, FIG. 1) in response to the change in the temperature of the fluid (32) to be old in the refrigeration art. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Wightman to modify the system of Koo in view of Yamaguchi, by adjusting pressure of the refrigerating fluid in the system by adjusting an orifice coupled to the heat exchanger *prior* to it entering the heat exchanger, but based on the temperature of the fluid *after* the heat exchanger with the heat generating device in order to have a precise and rapid response of the orifice to variations in volumetric expansion rate [0005].

Also, Koo in view of Yamaguchi does not disclose a particular type of refrigerant used, be it water, trichlorofluoromethane (R-23), pentafluoromethane (R-125), a zeotropic blend comprising R-404a, an azeotropic blend consisting of R-500 and R-502, or ammonia, as claimed by the applicant. Wightman shows that water, trichlorofluoromethane (R-23), pentafluoromethane (R-125), a zeotropic blend comprising R-404a, an azeotropic blend consisting of R-500 and R-502, or ammonia [0046], to be refrigerants common in the refrigeration art. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Wightman to modify the system of Koo in view of Yamaguchi, by specifying the type of refrigerant used in order to make the product more user and environment friendly.

6. Claims 5-7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of US PGPUB-Document US 2004/0089008 to Tilton et al. Koo in view of Yamaguchi discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat exchanger, substantially as claimed with the exception of stating the use of a reservoir to accommodate gas generated during boiling and reduce the change in pressure, said reservoir being downstream from the hear rejector and upstream from the pump. Tilton shows the use of a reservoir (25, FIG. 2) to accommodate gas generated during boiling and reduce the change in pressure, said reservoir being downstream from the hear rejector (30, FIG. 2) and upstream from the pump (40, FIG. 2) to be old in the refrigeration art. Also, since the reservoir is used to store the vapor, it would be an obvious design choice to have such tank at

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a sufficient volume to contain the maximum amount of gas generated in the heat exchanger.

Finally, the applicant is reminded that the use of a one piece construction instead of the structure disclosed in Tilton would be merely a matter of obvious engineering choice, *In re Larson*, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Tilton to modify the system of Koo in view of Yamaguchi, by using a reservoir, integral with the heat rejector and the pump to accommodate gas generated during boiling in order to reduce the change in pressure and prevent possible pump cavitation [0053].

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of US PG PUB-Document US 2004/0089008 to Tilton et al., as applied to claim 5 above and still further in view of U.S. Patent 6,775,996 to Cowans. Koo in view of Yamaguchi, further in view of Tilton discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat exchanger, having a reservoir to accommodate gas generated during boiling, substantially as claimed with the exception of stating that the reservoir is upstream of the heat rejector. Cowens shows the use of a reservoir (92, FIG. 2) to accommodate gas generated during boiling, said reservoir being upstream from the hear rejector (44, FIG. 2) to be old in the refrigeration art. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Cowens to modify the system of Koo in view of Yamaguchi, further in view of Tilton by using a

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reservoir to accommodate gas generated during boiling upstream of the heat rejector in order to use the gas as a heat exchanging fluid for another purpose (subcooler 52, FIG. 2).

8. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of US PGPUB-Document US 2004/0040695 to Chesser et al. Koo in view of Yamaguchi discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat exchanger, substantially as claimed with the exception of stating that the system is hermetically sealed, where the pressure varies less than 1 psi during a five year lifetime. Chesser shows the use of a hermetically sealed pumped loop cooling system [0042] to be old in the refrigeration art. Also, any hermetically sealed system is completely sealed, which provides no variations in the pressure, including a change in pressure of 1 psi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Chesser to modify the system of Koo in view of Yamaguchi, by using a hermetically sealed pumped loop cooling system in order to prevent outside elements from factoring in the cooling variations and the systems performance (sub-atmospheric conditions, [0042]).

9. Claims 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of U.S. Patent 6,023,934 to Gold. Koo in view of Yamaguchi discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat

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exchanger, substantially as claimed with the exception of disclosing a particular type of refrigerant used, be it a hydrocarbon like methane, or a cryogenic like helium. Gold shows the use of a hydrocarbon like methane (col 4, line 12), or a cryogenic like helium (col 1, lines 18-19) as a refrigerant to be old in the refrigeration art. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Gold to modify the system of Koo in view of Yamaguchi, by specifying the type of refrigerant used in order to make the product more user and environment friendly.

10. Claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over “Modeling of Two-Phase microchannel Heat Sinks for VLSI Chips” by Koo et al., in view of Japanese Patent 01-256775 to Yamaguchi, as applied to claim 1 above, and further in view of “A Closed-Loop Electroosmotic Microchannel Cooling System for VLSI Circuits” by Jiang et al. Koo in view of Yamaguchi discloses applicant’s basic inventive concept, a method of cooling a heat-generating device using a pump to cause a fluid flow in a heat exchanger, substantially as claimed with the exception of using an electroosmotic pump as pumping means and a catalytic recombiner, coupled to the inlet port of the pump, wherein the hydrogen and oxygen are combined to produce water. Jiang shows the use of an electroosmotic pump (page 4, lines 6-8) as pumping means and a catalytic recombiner (FIG. 8) to be old in the refrigeration art. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made from the teaching of Jiang to modify the system of Koo in view of Yamaguchi, by using an electroosmotic pump as pumping means since electroosmotic pumps do not require any movable parts and are very compact (page 4, line 8), and a catalytic recombiner,

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coupled to the inlet port of the pump in order to recombine the gas during electrolysis (page 9, lines 1-2).

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

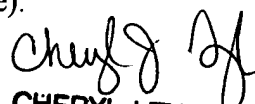
U.S. Patent 6,725,683 to Laskaris, Evangelos Trifon teaches a cryogenic cooling system for rotor having a high temperature super-conducting field winding.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Filip Zec whose telephone number is (571) 272-4815. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Filip Zec
Examiner
Art Unit 3744


CHERYL J. TYLER
PRIMARY EXAMINER

FZ